Rearing and Identifying Shrimp Larvae

At comparable stages of development, the larvae of penaeid shrimps are very similar and at times exhibit practically no differences between species. For example, Penaeus larvae occurring in the plankton of the northwestern Gulf of Mexico cannot yet be distinguished specifically and must therefore be treated as a single unit. To obtain full benefit from studies of the early life histories of commercially important shrimps, accurate differentiation of larvae is necessary. The presence or absence of specific differences at each larval stage cannot be ascertained until the larval development of the various species is known. Accordingly, this project has focused most attention on rearing penaeid larvae of known parentage and describing their developmental stages in great detail.

The young of penaeid shrimp pass through three larval stages (naupliar, protozoeal, and mysis) before becoming postlarvae. On three occasions, larvae hatched from eggs spawned by captive brown shrimp were reared to postlarvae. On one occasion each, larvae of two rock shrimps, Sicyonia dorsalis and S. brevirostris, were reared to (first) protozoeae. Eggs were also obtained from pink shrimp and Trachypeneus similis, but hatching did not occur. During periods when ripe penaeid shrimp were not available, larvae of other marine forms, such as caridean shrimps, crabs, and nudibranchs, were reared in an effort to improve upon established rearing procedures. Throughout every rearing trial, specimens of all stages of both penaeid and nonpenaeid larvae were preserved for descriptive purposes. Following is a brief discussion of the methods found to be most successful in rearing brown shrimp larvae.

Upon their arrival at the laboratory, ripe female shrimp which, hopefully, will yield viable eggs are placed in Fiberglas aquaria (one shrimp per aquarium) holding 80 liters (84.6 qt.) of water each. Water from the open Gulf with a salinity of from 36‰ to 38‰ is used most frequently, but water from Galveston Island's East Lagoon (28‰) has also been used successfully. Prior to use, the water is filtered through a cellulose filter which has a pore size of 5 microns. During the rearing process, the water is not recirculated, but is well aerated by means of compressed air.

Antibiotics are used only during spawning and hatching and are not added until evening because the brown shrimp spawns at night. When spawning, the shrimp apparently discharge metabolites which greatly enhance the growth of small micro-organisms. The antibiotics do not eliminate these micro-organisms but significantly retard development of their populations for at least 48 hr., thereby allowing time for the eggs to hatch and the larvae to be isolated. Good results have been obtained with a combination of sodium penicillin G and dihydrostreptomycin sulfate in concentrations of 50 international units/ml. and 50 micrograms/ml., respectively.

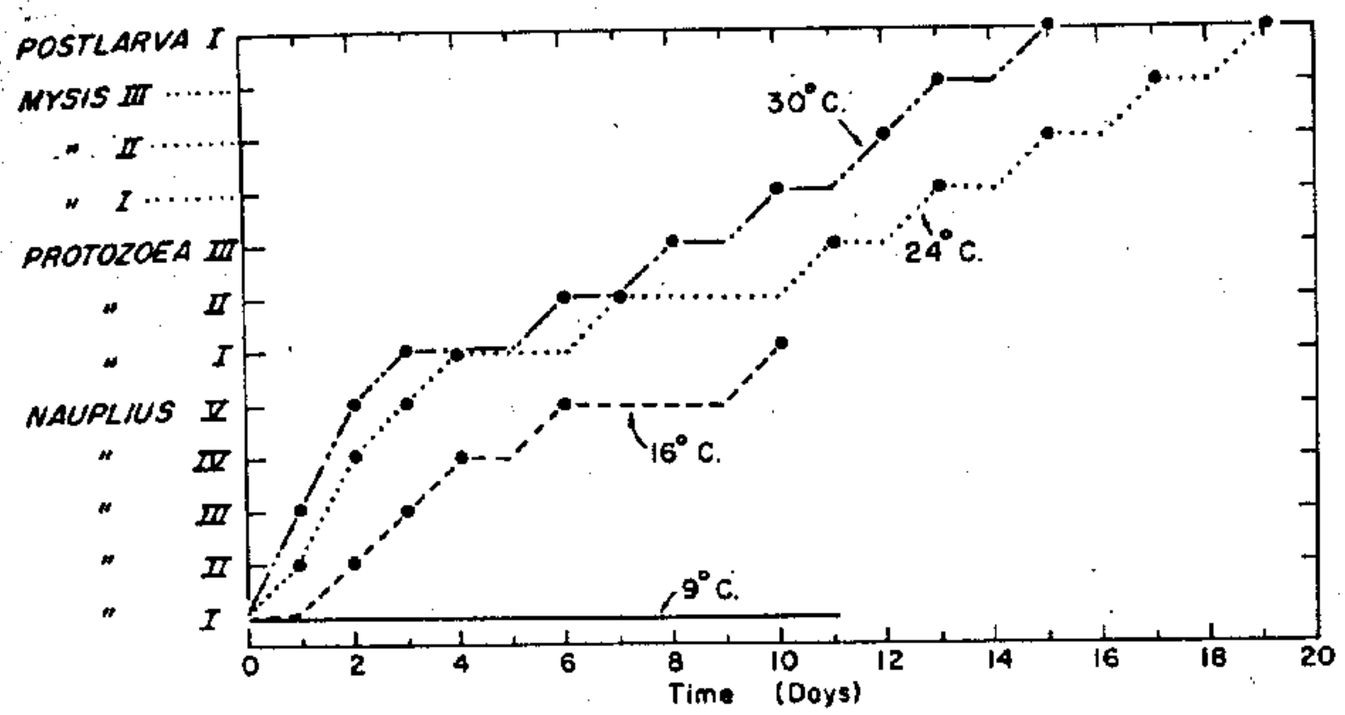
Brown shrimp larvae are relatively hardy and not prone to injury if handled gently. After hatching, the nauplii are carefully siphoned out of the large spawning aquaria and caught on a stainless steel screen, usually suffering no perceptible damage in the process. They are then placed in 250-ml. (8.4 oz.) beakers, each holding about 100 ml. (3.4 oz.) of rearing medium which is changed daily. Thirty nauplii can be easily maintained in each beaker. When the larvae reach the protozoeal stage, however, their numbers are reduced to 10 per beaker.

Development of a suitable medium in which to rear the larvae has been difficult, as varying results have been obtained with the same type medium in different rearing experiments. Attempts to rear the larvae in unenriched sea water have been unsuccessful, whereas best results have been obtained using "B_5" or "Miquel's" medium with soil extract. It is noteworthy, however, that pereiopods of larvae reared in the B_5 medium retain their exopods when molting to postlarvae. If these "abnormal" postlarvae are maintained in B_5, the exopods remain through at least six molts, but if they are placed in unenriched offshore water, the exopods are shed at the first molt. Similarly, when third-mysis larvae which have been reared in the B5 medium are placed in unenriched offshore water, they molt into normal postlarvae.

A diatom, Skeletonema sp., is used as food for the protozoeal stages; and brine shrimp, Artemia sp., for the later stages.

Temperature greatly affects the growth of the larvae. Temperatures of 28° to 30° C. (82° to 86° F.) are now regarded as the most suitable for laboratory culture of brown shrimp larvae. The most

rapid development from time of hatching to first postlarva was 12 days at 29° ± 1° C. Larvae will metamorphose at lower temperatures, but development is slower. The accompanying graph illustrates the results



Growth of brown shrimp larvae at four different temperatures.

of a rearing trial designed to assess the effects of temperature on larval growth. The experiment was initiated with active first nauplii that were hatched at 23.5° C. (74.3° F.). Larvae held at 9° C. (48° F.) were relatively inactive, exhibiting only feeble movement of their appendages while resting on the bottom. In each individual, the yolk was gradually absorbed starting posteriorly leaving what appeared to be an empty space within the body. Appendage movement could still be detected when the rear third of the body was completely void. Those nauplii held at 16° C. (68° F.) were not as active as those kept at higher temperatures, with only a few moving about at any given time. In contrast, all larvae held at 24° and 30° C. (75° and 86° F.) maintained themselves in the water column.

In all rearing trials to date, salinity has been kept above 34‰. As a result, we have no information on what effect a lower salinity might have on rate of development. Eggs, however, have been observed to hatch in water of lower salinity.

Brown shrimp nauplii and protozoeae are positively phototropic and, when reared under an overhead light source, swim to the surface where they may become trapped by the surface tension and die. Their survival is increased by supplying light laterally or rearing them in the dark.

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